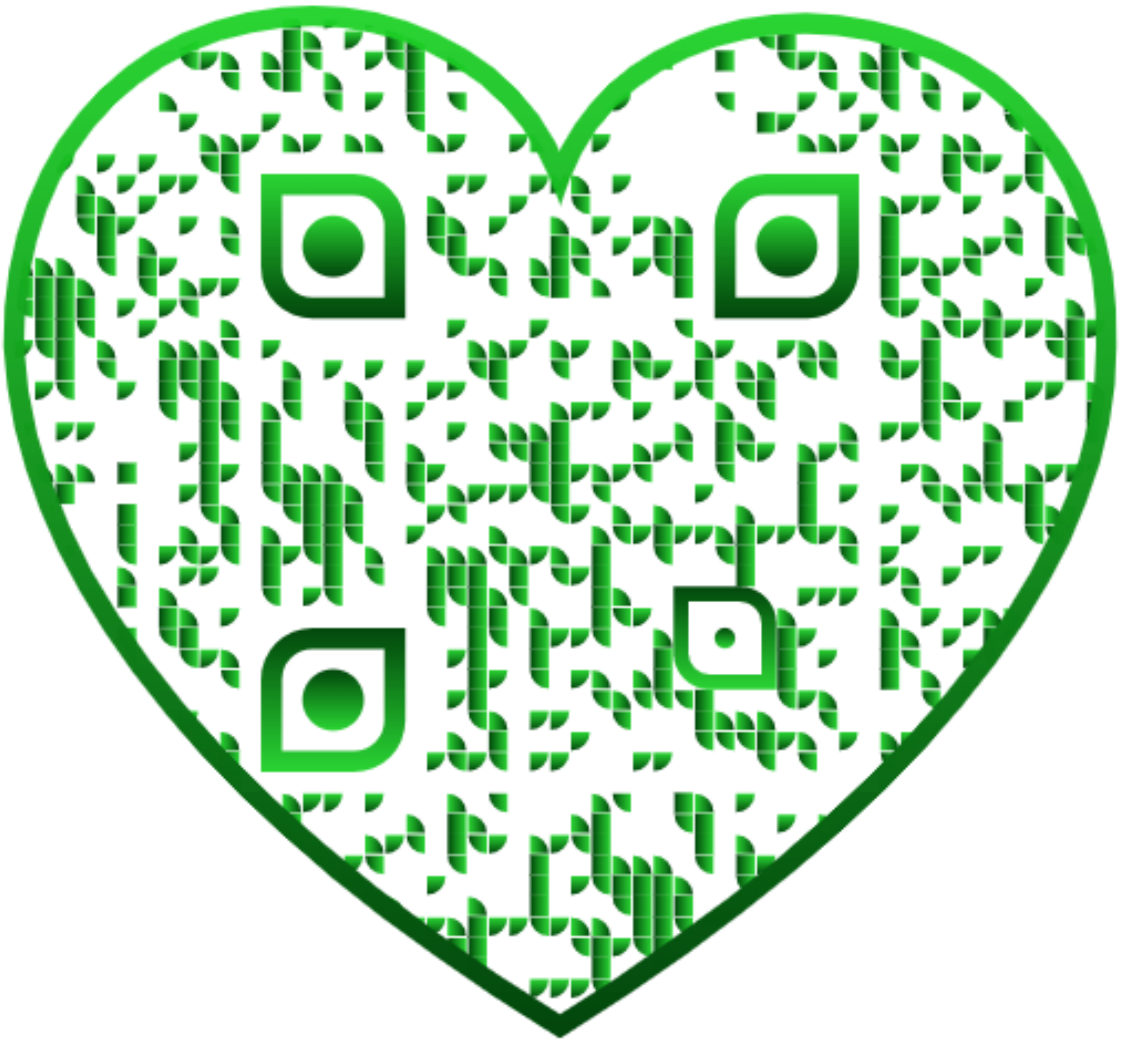
Ancient Egyptian Contributions to Science and Technology

Robin Walker



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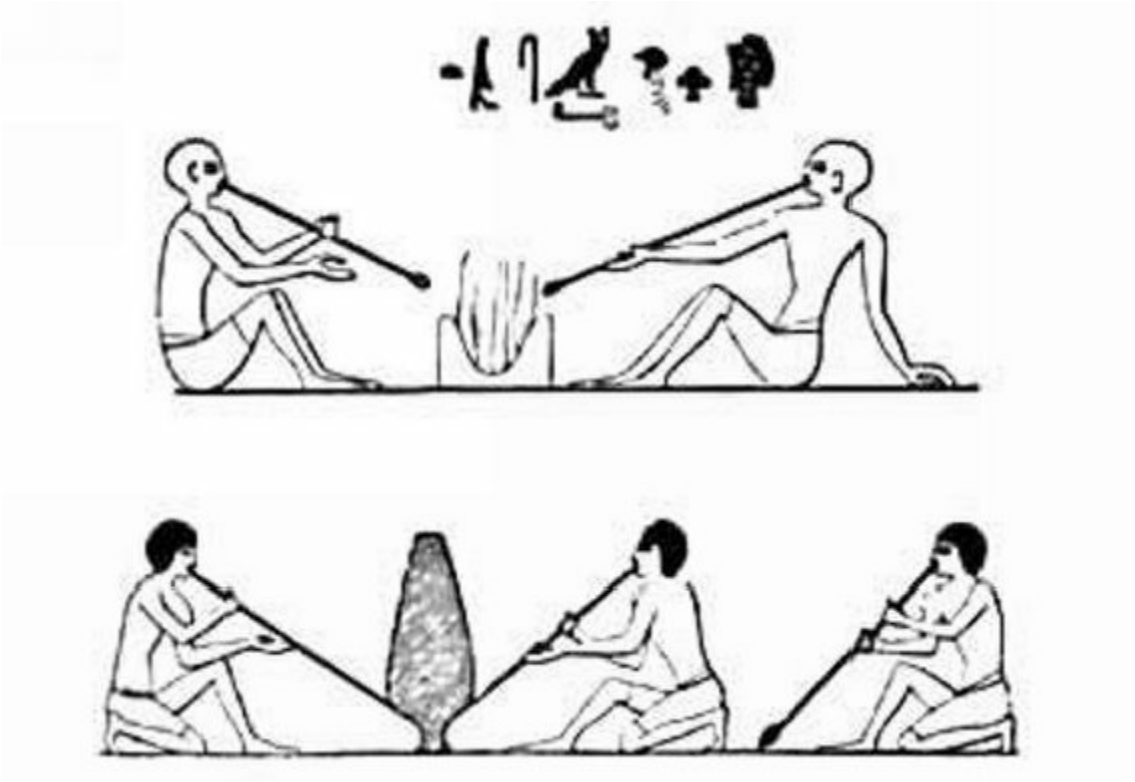

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Preface

While reading through *The Telegraph,* a Conservative British daily broadshee I came across a really interesting commentary by Jim Al-Khalili entitled *Science: Islam's forgotten geniuses* (29 January 2008) . The writer suggested why we in the West should have more respect for the contributions of non Western scholarship of the Middle Ages. The article cited an example that perhaps should be better known.

'Next year [says Al-Khalili], we will be celebrating the 200th anniversary of Charles Darwin's birth, and the 150th of the publication of his *On The Origin of Species,* which revolutionised our understanding of biology. But what if Darwin was beaten to the punch? Approximately 1,000 years before the British naturalist published his theory of evolution, a scientist working in Baghdad was thinking along similar lines. In the *Book of Animals,* abu Uthma al-Jahith (781-869), an intellectual of East African descent, was the first to speculate on the influence of the environment on species. He wrote: "Animals engage in a struggle for existence; for resources, to avoid being eaten and to breed. Environmental factors influence organisms to develop new characteristics to ensure survival, thus transforming into new species. Animals that survive to breed can pass on their successful characteristics to offspring." There is no doubt that it qualifies as a theory of natural selection.'

While this is undoubtedly an exciting and thought-provoking piece of information, a question that is sometimes raised but hardly ever addressed is: what else has African minds contributed to scientific and technological thought?

Western scholars are becoming more open to the contributions of Islamic scholars to the development of science and technology including some of the Black ones. Others are starting to embrace the contributions of the Mesopotamians, Indians and Chinese to science and technology. But where is non-Muslim Africa in this discussion? Where is the African Diaspora in this discussion?

African and African Diasporan science history is a subject that has had too little attention paid to it. Some important writers have ventured into the field; Professor Ivan Van Sertima, Professor Charles S. Finch III, Mr Hunter Havelin Adams III, Professor Cheikh Anta Diop, Dr Louis Haber, Professor Théophile Obenga and Dr Nnamdi Elleh. This work synthesises their findings and presents the data in an easy to digest, bite-size way.

This lecture essay is one of four essays that introduce African and African Diasporan contributions to science and technology. The other three in the series concern early West Africa, early East Africa and African Diasporan contributions to science and technology.

This ebook is a general introduction to the role played by the Ancient Egyptians in the origin and evolution of Mathematics, Astronomy, Medicine & Surgery, Navigation & Cartography, Architecture, Metallurgy and other areas that are more controversial.

Read and enjoy

Robin Walker 2016

Introduction

The basic building blocks of physics are a numerical system that can accommodate the three key ideas of distance, mass and time. Distance is a broad concept which encompasses length in one dimension, area in two dimensions and volume in three dimensions.

The basic building block of chemistry is the atom. Derived from the Ancient Greek concept of *atomos,* meaning indivisible, many early thinkers believed that if any particular substance was broken down to its smallest single unit, that unit could not be divided into anything smaller and thus constituted the foundation building block of all substances. Nowadays, scientists know that the atom is not actually the smallest building block. Moreover, atoms can be divided into even smaller particles. This does, however, show how the Ancient Greek idea has evolved into more complex modern ideas of the constituent elements of an atom.

The Ancient Egyptians, however, were responsible for the birth of all of these concepts. They created a sophisticated numerical system. They had rulers that measured length, clocks that measured time and scales that measured weight. Weight is not exactly the same concept as mass, but the ideas are close.

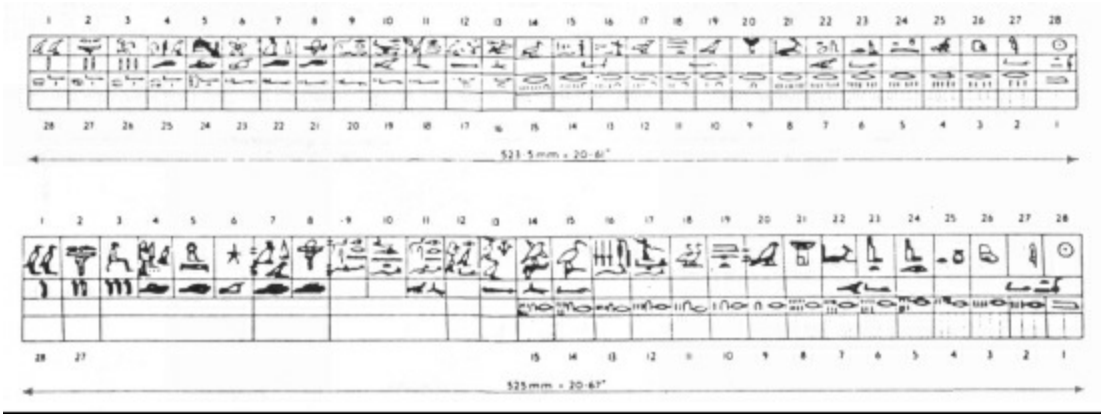

Figure 1. Sketch showing Ancient Egyptian measures of length from the era of Amenhotep I (ruled 1682-1662 BC) of the Eighteenth Dynasty. The primary unit was the royal cubit, the distance from the elbow to the tips of the fingers.

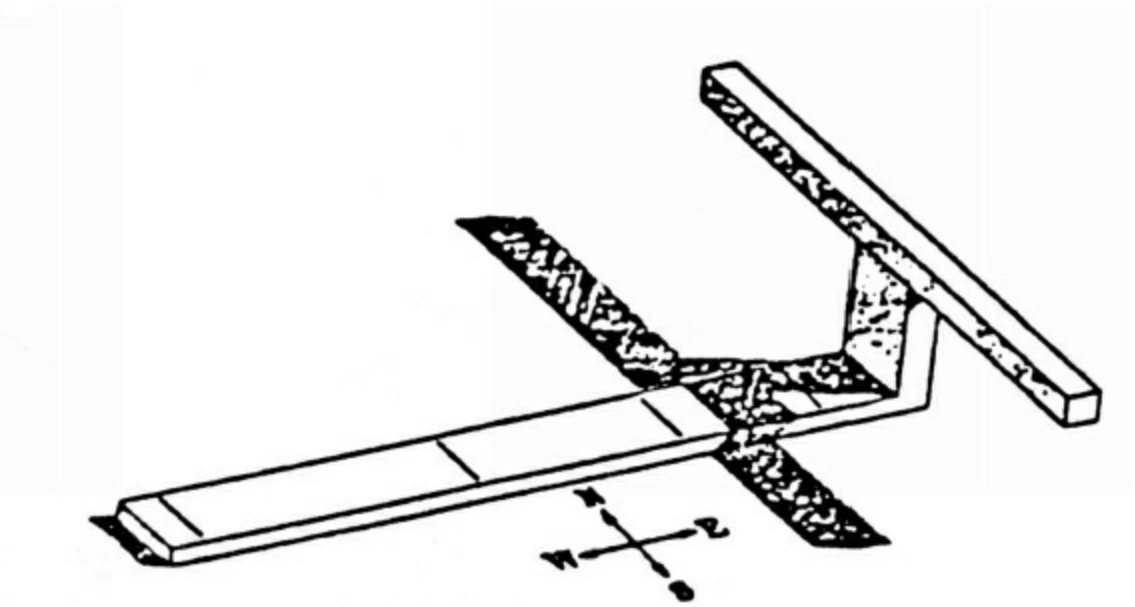

Figure 2. Sketch of an Ancient Egyptian shadow clock from around 1000 BC. Users of the clock typically placed the cross bar facing east in the morning and west in the evening. The hours were read from markings on the horizontal scale.

Figure 3. Taken from the Ancient Egyptian *Book of the Dead* (also called *Coming Forth By Day*), this scene shows the heart of an individual in the Netherworld being weighed against a feather. The idea was that a guilty person would have a heavy heart and an innocent person would have a light heart that would balance the feather. From a scientific perspective, this shows that the Egyptians had clear ideas about measuring weight.

According to Hunter Adams III, an African American science writer: 'Livio Catullo Stecchini, history of science professor at Harvard University, in an exhaustive study, documents how all contemporary systems of measure are based on standards established by the Egyptians. The Egyptian metrological system coordinated the standard of time – the speed of rotation of one or more points in the vault of heaven with the standard length – the "cubit" (0.523 meters, originally called the kush), with the standard for weight – the "qedet" (9 grams) and with the standard for volume – the "heqat" (4.5 litres). Thus the Egyptian measures of length, weight, volume, as well as time constituted a rational and organic system.'

Concerning the concept of the atom, the great scientist Sir Isaac Newton, suggested that the Ancient Greek *atomos* was derived from a concept called the monad, an idea which was ultimately of Ancient Egyptian and Phoenician

origin.

Moving from physics and chemistry theories to actual real-world practice, the Egyptians were important inventors and innovators. According to Mr Keith Holmes, an authority on Black inventors, the Ancient Egyptians invented or developed a number of useful products in a variety of industries.

Among these were adhesives (e.g. albumins, beeswax, clay, gelatin, gypsum, natron, starch), made great advances in agriculture (e.g. growing crops of almonds, barley, garlic, ginger, grapes, lentils, palm, sorghum), fermented alcohol (e.g. beer, wine, malts) and made products from animal materials (e.g. bone, butter, cheese, feathers, gut, ivory, mother of pearl, ostrich eggshell, parchment, tortoise shell). They also produced building materials (asphalt, brick, cement, mortar, plaster, sun dried brick), made cosmetics (e.g. perfumes, essential oils, cleansing cream), pioneered certain dyes (e.g. indigo, black, brown, green, red, yellow) and used certain fibres (e.g. cordage, papyrus, also developed techniques in basketry, brushes, matting, weaving). They made glazed ware (e.g. glazed steatite, faience variants, glazed quartz), used gums and resins (e.g. acacia, cedar, copal, frankincense, myrrh, pine), invented various colours of ink (e.g. black, brown, green, blue, white), created a vast range of metals and alloys (e.g. alumina, aluminium, antimony, brass, cobalt, copper, copper-antimony alloy, copper-gold alloy, gold, electrum, hematite, silver, tin) and worked with a variety of minerals (e.g. alum, barites, emery, feldspar, graphite, manganese compounds, mica, sulphur). They used various oils, fats and waxes (e.g. almond oil, belanos oil, bean oil, castor oil, coconut oil, juniper oil, walnut oil), used paints and pigments (e.g. black, blue, grey, orange, pink, red), used various precious and semi-precious stones (e.g. diamonds, emeralds, opal, ruby), and had a well

developed industry in pottery (e.g. kilns, moulds, varnishing, polishing). Finally, the Egyptians used spices (e.g. cinnamon, dill, cumin, parsley), created textiles (e.g. cotton, linen) and used a variety of wood in art and building (e.g. Egyptian timber, beech wood, birch, carob-wood, cypresswood, ebony, elm, fig, hornbeams, maple, plywood).

Chapter 1: Mathematics

The Ancient Egyptians made important contributions to the origin and evolution of mathematics. The Ancient Greek scientist, Aristotle, recognised this and wrote the following in his work *Metaphysics:* 'And thus Egypt was the cradle of the mathematical arts.'

Four Ancient Egyptian mathematical documents survive today and have been the subject of considerable research by modern scholars – the *Rhind Papyrus*, the *Berlin Papyrus,* the *Moscow Papyrus* and the *Kahun Papyrus.* These papy indicate that a large proportion of high school mathematics was created by the Ancient Egyptians.

The Egyptians had a decimal system with special symbols for the numbers 1, 10, 100, 1,000, 10,000, 100,000 and 1,000,000. They had fractions, but these are always given as 1/2, 2/3, 1/3, 1/4, 1/5, 1/6, etcetera. With the exception of 2/3, all the other fractions were expressed as one over two, one over three, and so on. These are called unit fractions. If the Ancient Egyptians wanted to express 3/4, they would write 1/2 + 1/4. In a similar vein, if they wanted to express 2/5, they would write 1/3 + 1/15. They were adept at handling fractions. Problem 33 of the *Rhind Papyrus,* for example, required the student to calculate 16 + 1/56 + 1/679 + 1/776 + 10 + 2/3 + 1/84 + 1/1358 + 1/4074 + 1/1164 + 8 + 1/112 + 1/1358 + 1/1552 + 2 + 1/4 + 1/28 + 1/392 + 1/4753 + 1/5432 = 37!

The *Rhind Mathematical Papyrus* was probably a Middle Kingdom Period (i.e. Eleventh or Twelfth Dynasty) student's copy book that contains 87 mathematical problems and their solutions. Belonging to an individual

student called Ahmose, the text is a record of what he was taught. Beginning with arithmetic and number theory, the student worked with formulae in the areas of algebra, geometry, trigonometry and *pi* . For example, problem 24 asks: ‘A quantity plus its seventh becomes 19. What is the quantity?’ It required the student to solve for one unknown called ‘aha’ meaning ‘heap’. If problem 24 was written today ‘aha’ would be transcribed as ‘x’ and the question would look like this: $x + x/7 = 19$.

Problem 41 asks: ‘Find the volume of a cylindrical granary of diameter 9 and height 10.’

Problem 50 addresses the area of circle. The question asks: ‘Example of a round field of diameter 9 khet; what is the area?’ The suggested formula and method gave an approximation for π as 256/81 which is 3.1605 to 4 decimal places. This is closer to the real figure of π (i.e. 3.14159 etcetera) than the figure 3 used by the Ancient Babylonian mathematicians.

Problem 51 asks: ‘A demonstration of the calculation of a triangular plane. If asked: A triangle 10 rods high, 4 at its base; what’s its area?’

Problem 52 asks: ‘[T]rapezium of 20 khet, with a large base of 6 khet and a small base of 4 khet. What is its surface?’

These four problems (41, 50, 51, 52) thus address the volume of a cylinder, the area of a circle, the area of a triangle, and the area of a trapezium. What else is in the papyrus?

Problem 56 asks: ‘If a pyramid is 250 cubits high and the side of its base 360

cubits long, what is its seked?’ This is a trigonometry problem requiring the student to calculate the seked (or cotangent) of the slope of the pyramid.

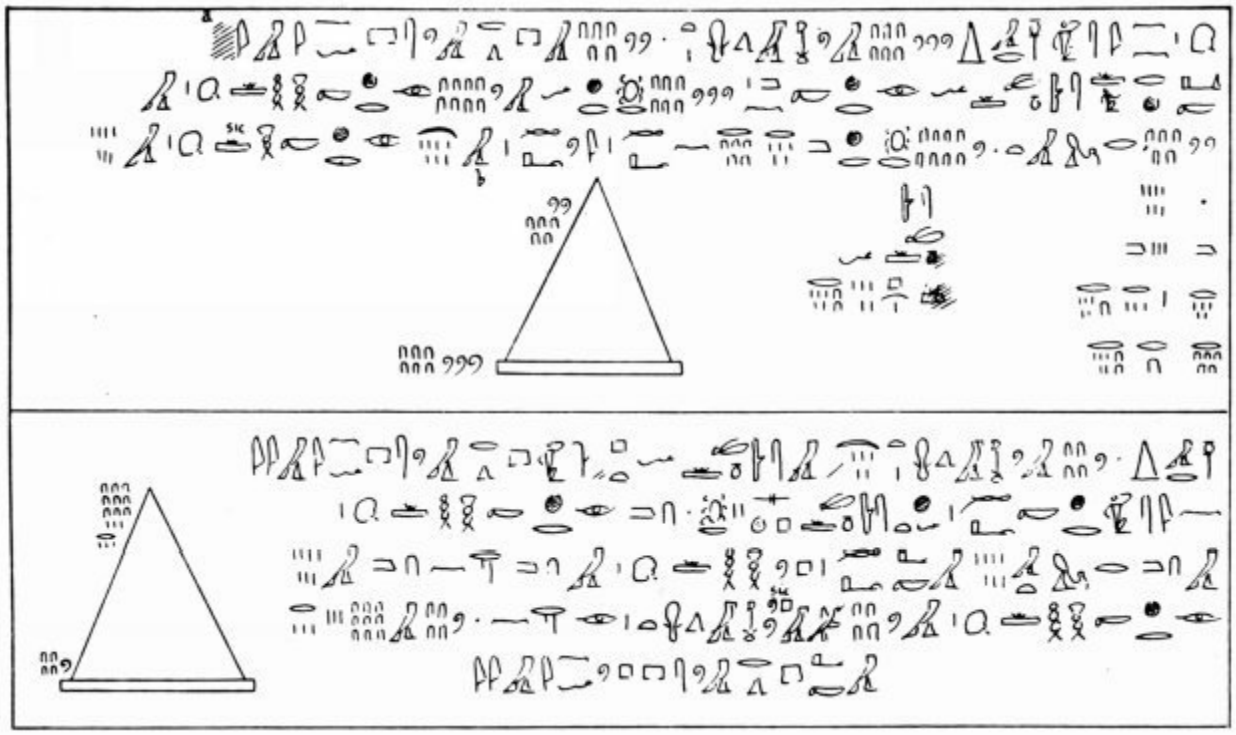

Figure 4. Sketch of problems 56 and 57 from the *Rhind Mathematical Papyrus.* These are the oldes known examples of trigonometry depicted in a mathematical document.

Problem 79 asks: ‘Inventory of an estate: Houses: 7 Cats: 49 Mice: 343 Barley seeds: 2401 Bushels: 16807.’ According to Professor Théophile Obenga, a leading authority on Ancient Egyptian texts, this means: ‘Suppose that on an estate of 7 houses, each house had 7 cats, each cat killed 7 mice, each mouse ate 7 barley seeds, and each barley seed would have yielded 7 bushels; how many bushels would that make all told?’ In mediaeval times the Italian mathematician Fibonacci wrote: ‘Seven old women went to Rome: each woman had seven mules; each mule carried seven sacks: each sack contained seven loaves; and with each loaf were seven knives; each knife was put up in seven sheaths.’ This is a seven step geometric progression of 7 x 7 x 7 x 7 x 7 = 16807. If written today, the question would have said: ‘Find the sum of 5 terms of the Geometric Progression whose first term is 7 and whose

common ratio is 7.’

The *Moscow Mathematical Papyrus* contains 25 mathematical problems of which Problems 10 and 14 are widely regarded as high points in the evolution of Ancient Egyptian mathematics.

Problem 10 asks: ‘Method of calculating a basket. If it is said to thee, a basket with an opening of 4 1/2 in its containing, Let me know its surface.’ The term basket means ‘hemisphere.’ Thus, the problem concerns the difficult problem of calculating the surface area of a hemisphere. The formula the scribe used was S = 2d x (8/9) x (8/9) x d, where S is the surface area and d is the diameter, which is almost equivalent to $S = 2\pi r^2$, the way the formula is presented today. The only difference is that the Egyptians reckoned π to be 256/81 or 3.1605.

Problem 14 asks: ‘Method of calculating a truncated pyramid. If it is said to thee, a truncated pyramid of 6 ellen in height, of 4 ellen of the base, by 2 of the top.’ The solution used the formula of $V = h/3 (a^2 + ab + b^2)$ where V is the volume, a is the base, b is the length of the top, and h is the height. Historians of science and mathematics claim that this method has not been improved on in 4000 years!

The *Berlin Mathematical Papyrus* contains formulae for solving for two unknowns. Problem 1 asks: ‘How to divide 100 into two parts such that the square root of one part is 3/4 of the square root of the other part.’ In modern algebraic expressions, it looks like this: $x^2 + y^2 = 100$, where $y = 3/4x$. Other scholars present it like this: $x^2 + y^2 = 100$, where $4y - 3x = 0$. Either way, everyone agrees that this problem requires calculating two unknowns, x and

y, from two simultaneous equations.

The *Kahun Papyrus* Plate VIII has a mathematical problem on it that has baffled scholars. Professor Cheikh Anta Diop, the brilliant Senegalese scholar, speculates that it is dealing with the volume of a sphere with a hemisphere of 8 units in diameter. Other writers holding a different opinion think it concerns the volume of a cylindrical silo of 8 units in diameter and 12 units it height.

The Ancient Egyptians made other contributions to mathematics that I shall summarise briefly. They pioneered the 3, 4, 5 triangle which is the basis of the so-called 'Pythagorean Theorem.' They used this triangle to accurately calculate right angles. That the Egyptians knew this triangle, the following excerpt by Plutarch, the great Greco-Roman scholar, is most edifying: 'The Egyptians appeared to have figured out the world in the form of the most beautiful of triangles … This triangle, the most beautiful of triangles, has its vertical side composed of three, its base of four, and its hypotenuse of five parts, and the square of the latter is equal to the sum of the squares of the two sides.'

Finally, there is evidence of a more controversial and contested nature that the Old Kingdom Egyptians knew about irrational numbers. Many scholars credit the Egyptians with the knowledge of the square root of 2 (1.4142), a more detailed understanding of pi or π (3.14), and also phi or φ (1.618). This data was built into the proportions of the Great Pyramid of Giza.

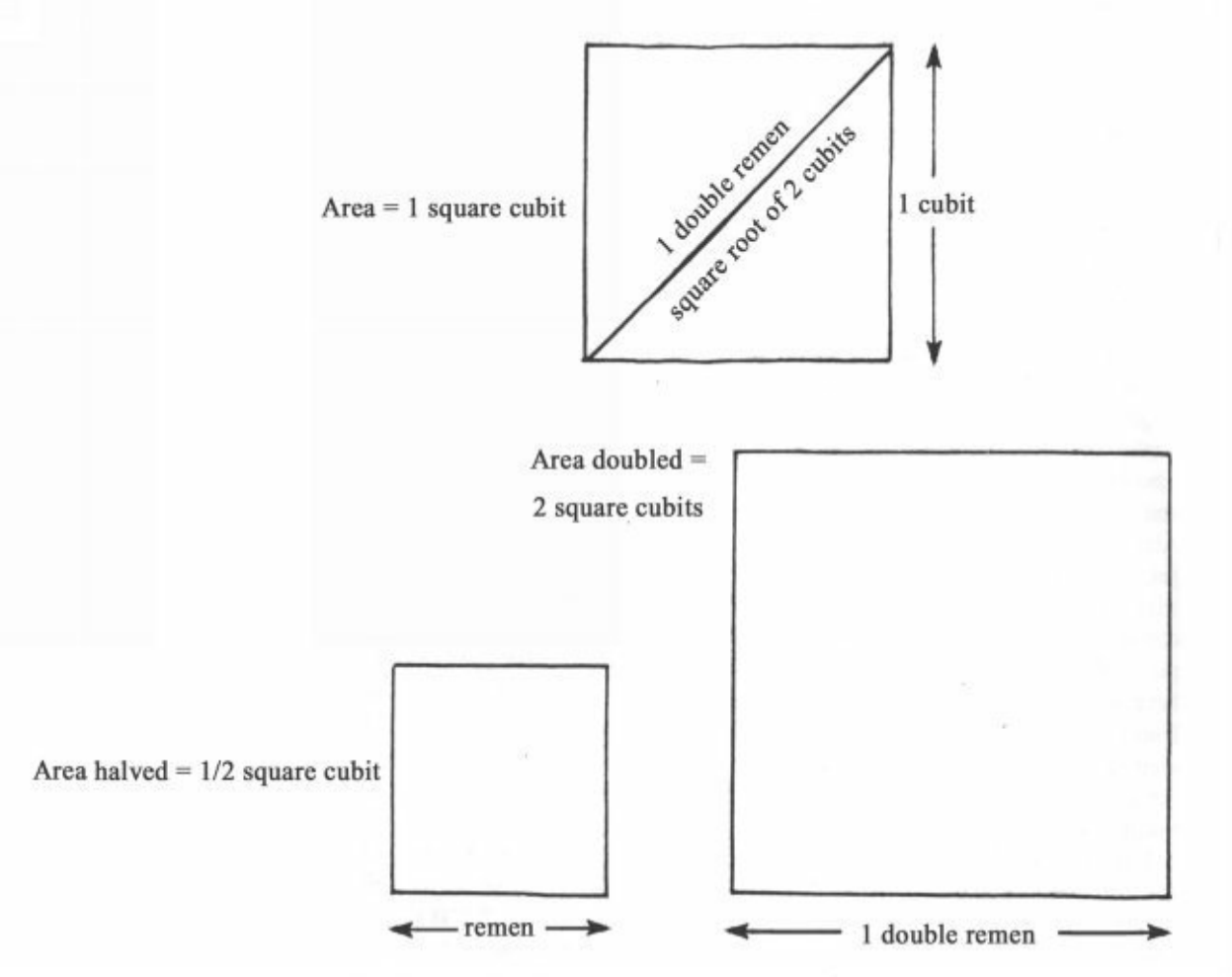

Figure 5. As Professor Beatrice Lumpkin points out with these squares, there is a demonstrable relationship between an Egyptian royal cubit and another Egyptian measurement called a double remen. A double remen is equal to the square root of 2 royal cubits. This is particularly interesting because the square root of 2 equals 1.4142 etcetera. It is an irrational number. Many scholars see this as convincing evidence that the Ancient Egyptians were familiar with the concept of irrational numbers.

Chapter 2: Astronomy

Astronomy is the science of mapping the heavenly bodies including the sun, the moon, the stars and the other planets. Throughout the ages, humans have used astronomy to tell the time, devise calendars, orientate buildings and as a guide to travel.

The Ancient Egyptians pioneered the use of the sundial, the clepsydra (water clock) and the merkhet (i.e. a device using a straight edge and a plumb line to measure stars). The Ancient Egyptians also wrote texts on astronomy that were famous in Greek and Roman times but unfortunately have not survived into our times. One document was called *On the Disposition of Fixed Stars and Stellar Phenomena.* Another text was entitled *On the Disposition of the Sun, Moon and Five planets.* Yet another document was called *On the Syzygie and Phases of the Sun and Moon.* A fourth text was called *On Risings.*

Figure 6. Water clock from Karnak used for estimating the time over the twelve hours of night.

Duncan MacNaughton, author of the erudite *A Scheme of Egyptian Chronology*, reproduced an image of the astronomical ceiling in the Tomb of Senenmut, a contemporary of Hatshepsut (seventeenth century BC). The ceiling has twelve months of the year depicted. He also reproduced a picture of the heavens from the Ramesseum (fourteenth century BC), again with the twelve months of the year depicted.

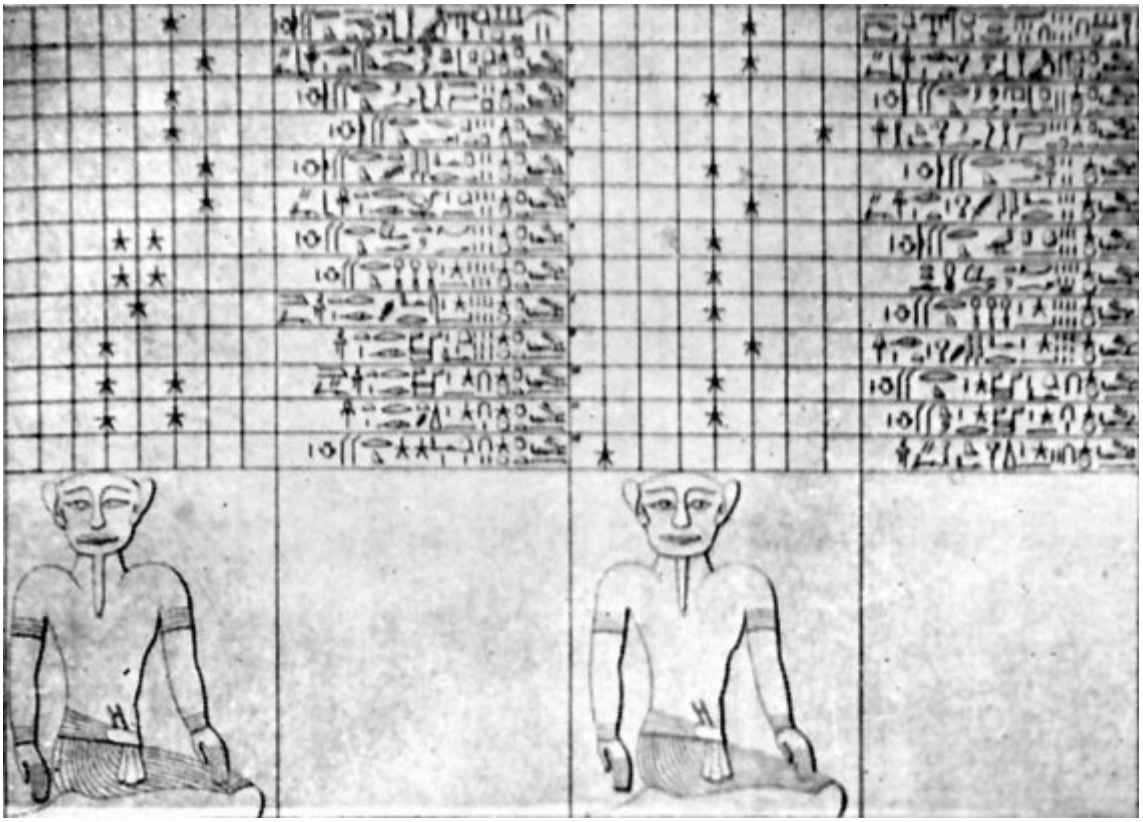

Figure 7. Detail from a star calendar from the time of Rameses VI of the Twentieth Dynasty which, according to Duncan MacNaugton, represents 'a star calendar for each of the twelve hours of night on the 1st and 16th of each month of the year.'

The Ancient Egyptians invented the 365 day solar calendar based on astronomical observation. They also created the concept of the month and the zodiac based on the grouping of stars. They grouped at least 43 stellar constellations.

Their most important contribution to astronomy, however, was their creation of the Sothiac or Sothic Cycle which is superior to the concept of the leap year that we use today. The Sothiac Cycle is based on the fact that the earth spins 365¼ times each time it orbits the sun. Since it is impractical to have the concept of ¼ of a day, we moderns have adopted the practice of having a

leap year of 366 days once every four years to ‘correct’ for this problem.

The Ancient Egyptians had a cleverer way of dealing with this. They ran a civil calendar of 365 days but also ran a more accurate calendar of 365¼ days at the same time. After one year, the two calendars would disagree by ¼ of a day. After two years, the two calendars would disagree by ½ a day. After three years, the two calendars would disagree by ¾ of a day. After four years, the two calendars would disagree by a whole day. We can therefore calculate that after eight years, the two calendars would disagree by two days. After twelve years, the two calendars would disagree by three days, etcetera. Keeping these calculations going, after 1460 years of 365¼ days, the two calendars would disagree by a whole year and thus the first day of the year on one calendar would be the first day of the year on the second calendar! The 1460 year period is called the Sothiac Cycle.

A Roman scholar called Censorinus stated that the two Egyptian calendars met up with each other in 139 AD. This meant that the two calendars met up with each other 1460 years earlier i.e. 1321 BC. The two calendars met up with each other 1460 years before this, i.e. 2781 BC. Finally, the two calendars met up 1460 years before this, i.e. 4241 BC. Thus the Egyptian astronomers did not need to use the concept of a leap year.

Concerning the origin of the zodiac, there was a lively battle between Sir E. A. Wallis Budge and Dr Albert Churchward in the early twentieth century over whether the Ancient Egyptians or the Ancient Greeks invented it. The argument centred on the zodiac painted on the ceiling of the Temple of Hathor at Denderah. The temple was known to have been very ancient and may have dated to the time of Fourth Dynasty Pharaoh Khufu (4824-4761

BC). However, the temple standing there today was renovated in the time of the Greek rulers of Egypt, the Ptolemaic Dynasty. So the controversy is this: Did the Greeks add the zodiac to the renovated building or was it there in Pre-Greek times possibly as early as the time of Khufu?

Figure 8. Sketch of the Denderah Zodiac from a controversial Egyptian Temple built by the Egyptians but renovated by the Greeks. Who was responsible for the zodiac?

A careful examination of the Denderah Zodiac shows that the image of Cancer is not a crab, as one might expect, but it is actually Khepera the dung beetle. The significance is this. Europe does not have dung beetles, and thus Europeans changed the dung beetle into a crab. Therefore, had the Greeks invented the zodiac they would have placed a crab there instead of a dung beetle. We conclude therefore that Dr Churchward was correct. There was, however, Greek influence on this zodiac. Two of the animals are depicted looking to the side and are shown with dramatic poses that differ from the stiff formalism of Ancient Egyptian art. All the other animals show the stiff formalism of Ancient Egyptian art. It is thus easy to distinguish Egyptian

originals from the Greek influences. This all combines to suggest that the Denderah Zodiac was indigenous in origin.

The Roman geographer Strabo wrote a comment in his *Geography* which was most edifying on this subject: ‘The Greeks lacked knowledge of the real length of the year and several similar facts until translations of the memoirs of Egyptian priests into the Greek language spread these ideas among astronomers, who have continued to this day to rely heavily on this same source.’

The zodiac divides the year into twelve houses or constellations. This is one of the ways that the concept of the twelve months of the year came about. If the Ancient Greeks lacked indigenous knowledge of the true length of the year they could not have divided it into the twelve months.

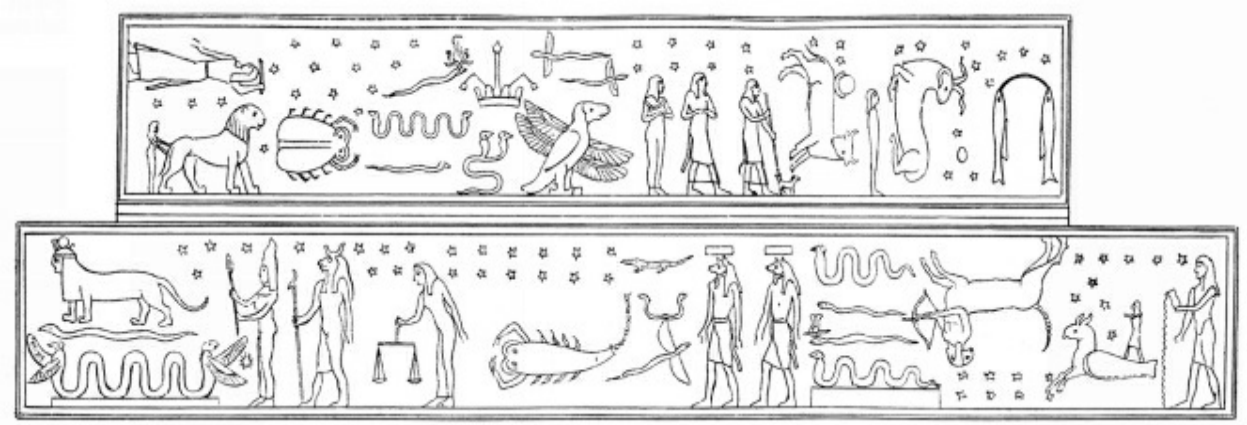

Figure 9. Zodiac from the Temple of Esneh. Duncan MacNaughton feels that this 'may be a late version of an earlier zodiac.' In support of this idea, he points out that: 'The zodiac also has the peculiarity that before the sign Virgo a Sphinx is inserted, a lion with the head of a woman, surely a symbol of the transition from Virgo to Leo. This suggests that the colossal Sphinx carved out of rock near the pyramids of Cheops and Kephren belongs to the same period. It is usually attributed to Kephren and therefore if from internal evidence the date of this zodiac can be fixed we obtain a probable date for Kephren.' If MacNaughton is correct about this, then the original on which it was based would go back to the Fourth Dynasty i.e. to the time of Khehpren better known as Khafra, the son of Khufu mentioned earlier.

The Ancient Egyptians pioneered the heliocentric theory i.e. the idea that the earth and the planets orbit the sun (says Sir Isaac Newton). They knew of the planets Mercury, Venus, Mars, Saturn and Jupiter. The year is, of course, the orbit of Earth around the Sun. The month is, of course, the orbit of the Moon around the Earth. They calculated and predicted lunar eclipses. This is where the earth comes between the sun and the moon, which causes the earth to throw its shadow over the moon. Moreover, the Egyptians invented the hour. This is the length of time it takes the moon to move its own diameter relative to the sun.

The earth wobbles as in spins, just like a spinning top. This produces two measurable effects as far as we earthlings are concerned, the precession of the equinoxes and the changes in the circumpolar constellations.

The precession of the equinoxes can be explained as the very slow, cyclic changes in the coordinates of the fixed stars that takes place over a time period of approximately 25,900 years. This enormous period of time is called a Great Year (of 25,900 years) and can be divided into smaller units called an Age or a Great Month (of 2,160 years). Twelve Great Months is equal to one Great Year (i.e. 2160 x 12 = 25,920). The Ancient Egyptians discovered this when they noticed that when the sun rose on the morning of the Spring Equinox, the longest day of the year, there was a particular zodiacal constellation on the Eastern horizon where the sun rose. On each Spring Equinox, they expected to see the same zodiacal constellation. However, after a period of 2160 years, the zodiacal constellation at the Spring Equinox where the sun rose changed to the next zodiacal constellation. After another period of 2160 years, the Spring Equinox would change to the next zodiacal constellation. It would take a Great Year of approximately 25,900 years to complete the cycle to where the sun would rise on the morning of the Spring Equinox where the first zodiacal constellation would be on the Eastern horizon. This phenomenon is called the precession of the equinoxes because the changes to the zodiacal sign over each Great Month goes backwards (i.e. the precession) to the previous zodiacal sign and not forwards to the next zodiacal sign as one would expect.

Other scholars present this information in other ways. According to George Goodman: ‘Our entire solar system with all its planets and moon describes a huge circle around another sun in space, viz., the star Sirius. This movement

takes 25,920 years to complete and, during that time, our Sun appears [to us earthlings] to traverse through various constellations or star clusters … By arbitrarily dividing that huge circle into twelve sections (or houses) they gave to each of them an appropriate sign and name and called the duration of 2,160 years an age. Twelve of these ages constitute one complete turn of our solar system around Sirius.'

Sir Norman Lockyer, the great English astronomer, proved that the Ancient Egyptians knew this by showing that the Egyptians re orientated their temples to keep them in line with shifting stellar phenomena over the thousands of years.

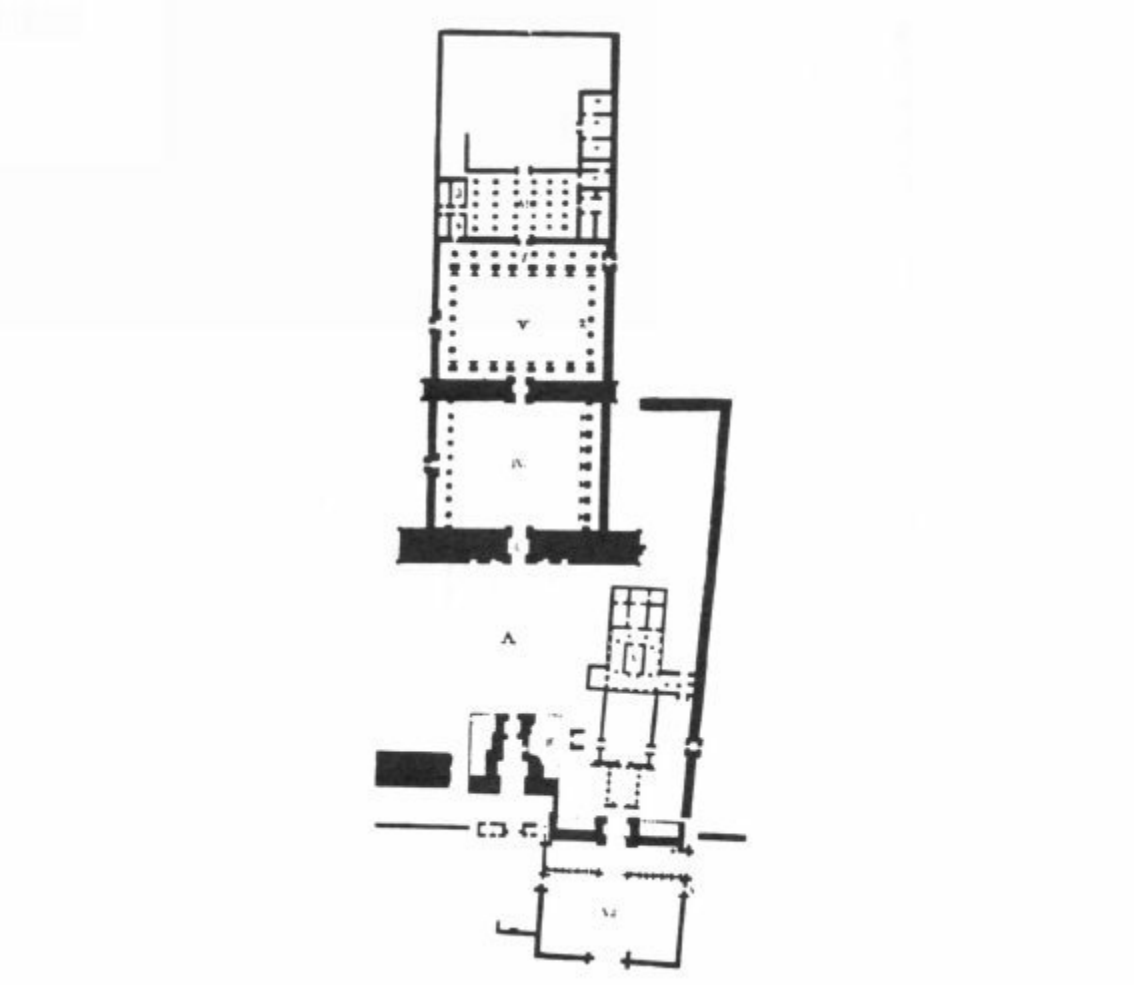

Figure 10. Sir Norman Lockyer suggested that the altered plan of some of the temples, such as this one at Medinet Habu, was a response to the precession of the equinoxes.

The circumpolar constellations can be described as the constellations that the North Pole of the earth would point to if it was extended into space. It is considered a pole, because these are the constellations that appear to change their positions THE LEAST as the earth turns on its axis. However, changes in the circumpolar constellations take place every 3,700 years. In the period of a Great Year they change seven times (i.e. 3700 x 7 = 25,900).

A number of scholars writing over the last two hundred years believe that the

Ancient Egyptians discovered both phenomena; the precession of the equinoxes and the changes in the circumpolar constellations. Some of these writers also claim that the Ancient Egyptians began calculating both phenomena beginning 10,858 BC. As an example, Richard Allen wrote: ‘Many have maintained that Egypt was the first to give shapes and names to the star-groups; Dupuis, perhaps inspired by Macrobius of our 5th century, tracing the present solar zodiac to that country and placing its date 13,000 years anterior to our era.’

Professor Théophile Obenga, the great Congolese Egyptologist, noticed some interesting scientific ideas hidden in two Ancient Egyptian religious hymns.

Pharaoh Akhenaten of the Eighteenth Egyptian Dynasty wrote *The Great Hymn to Aten.* A passage in the hymn read as follows: ‘Living sun disk, you who brought life into being … trees and grass grows green … your rays reach deep into the great green sea.’ Professor Obenga noticed the link between sunlight giving life and the colour green. He believes that this is an early understanding of the concepts that we moderns would call photosynthesis and chlorophyll.

Stele 826 in the British Museum contains the text of *Hymn to Amen Ra.* A passage from this hymn read as follows: ‘In one short day you voyage millions of leagues and hundreds of thousands. Each day is just an instant for you.’ Professor Obenga noticed that this is a reference to the vast speed at which light travels. The actual figure is 5 hours from the Sun to Pluto, the farthest planet.

Chapter 3: Medicine and Surgery

The Ancient Greek poet, Homer, stated that: ‘In medical knowledge, Egypt leaves the rest of the world behind.’

According to the Ancient Egyptian historian Manetho, Pharaoh Djer (5581-5524 BC), of the First Dynasty, wrote a book on anatomy. The same historian reported that Pharaoh Djet (5507-5476 BC), also of the First Dynasty, wrote a famous medical text. Scholars today believe they have identified the Djet era text. They think it has survived as the *Edwin Smith Surgical Papyrus.*

Figure 11. Detail from the *Edwin Smith Papyrus.*

The *Edwin Smith Papyrus* is now housed in the New York Academy of Medicine. It was one of ten surviving Ancient Egyptian medical texts. It describes 48 cases of bone surgery and of external pathology. It demonstrates a detailed knowledge of anatomy, gives remarkably accurate descriptions of traumatic surgical lesions, and describes their treatments where applicable.

Though written during the Eighteenth Egyptian Dynasty, it is a copy of a

much older Egyptian text. The Eighteenth Dynasty copyist included glossaries for the readers because the original language nearly 3,000 years earlier was just too archaic.

What has survived is only one third of the original manuscript that stops at the 48th case. Consequently it deals only with the skeletal and soft tissue parts of the head and neck, i.e. the upper portion of the body. It uses nearly 100 anatomical terms in the head and neck regions.

Each case is written out as (i) an examination, (ii) a diagnosis, (iii) a treatment (iv) and finally, glossaries to explain the First Dynasty language to an Eighteenth Dynasty surgeon.

Professor Charles Finch, a medical doctor, who has made a special study of the contents of this papyrus, was somewhat baffled by the standards of medical knowledge achieved. He notes that: ‘Cases 29-33 all represent additional case descriptions of vertebral dislocations and sub-luxations and their clinical consequences. At present, some of these conditions are almost impossible to detect or describe fully without X-ray studies. The question then arises is how did our ancient surgeon, living a[n]d practicing [thousands of] years ago, manage to diagnose and describe these problems without benefit of X-rays?’

To answer Professor Finch, we just don’t know.

Professor Théophile Obenga was also impressed with this document. Case 31 deals with a fracture causing a dislocation of the cervical vertebrae. This led to quadriplegia in the patient. This case demonstrates that the Egyptians

understood the connections between injuries to the central nervous system and peripheral damage elsewhere. This implies they recognised the unity of the nervous system and the interconnection of central and peripheral nerves.

Professor Finch informs us that the Ancient Egyptians had a total of perhaps 200 terms for the different parts of the human body that appear in their papyri. There are Ancient Egyptian terms for bones of the head--the cranium, cranial vault, cranial sutures, suture membrane, superciliary arch, orbit, mandibular notch, the internal auditory canal and the external auditory canal. There are terms for the soft tissue parts including the meninges, cerebrum, convolutions of the brain, nasal fossa, nasal cartilage, pharynx, spinal cord, larynx, and oesophagus. For the skeleton, there are terms for the manubrium, sternum, patella, clavicles, scapula, humerus and thoracic vertebra. For the internal organs, there are terms for the liver, intestine, lung, pericardium, stomach, spleen, pancreas, kidney and bladder. Finally there are terms for cerebral spinal fluid, the blood vessel network, the spinal-cord, et cetera.

It should also be borne in mind that with thousands of years of practising mummification, the Ancient Egyptians amassed an array of knives, scalpels and surgical techniques. They used red hot implements to seal off bleeding. They closed wounds with adhesive tape or sutures. Mummification itself took a team of skilled medical personnel perhaps 70 days to complete. Among the many actions needed to complete a mummification, involved evisceration, removing the brain, desiccation, washing the body inside and out using natron, anointing the purified body with aromatic oils and herbs, and wrapping the body in endless bandages. Among the chemical substances involved in the process were palm wine, various spices, perfumes, myrrh,

aniseed, onions and natron.

Professor Théophile Obenga was very impressed with the *Ebers Papyrus* and describes it as humanity's first medical encyclopaedia. It has chapters on intestinal disease, ophthalmology, dermatology, gynaecology, obstetrics, pregnancy diagnosis, contraception, dentistry, surgical treatment of abscesses, tumours, fractures and burns. The *Papyrus* has a section on the movement of the heart and pulse cited from and older text called *The Book of the Heart and Vessels* . This document describes how the heart pumps blood around the body. What it did not say was that the blood returns to the heart. It was this discovery that made William Harvey, the seventeenth century English scholar, famous. The *Papyrus* also describes in arcane and picturesque language certain heart ailments such as angina pectoris and Stokes-Adams attacks. Finally, the *Ebers Papyrus* has a section on diagnostic percussion.

Some earlier writers were of the opinion that the Egyptians knew nothing about the function of the brain. Professor Finch points out that Egyptian art shows the raised serpent coming out of the vertex of the cranium on the Pharaonic headdress. He believes that the position of the serpent symbolically divides the cranium into two equal halves or hemispheres. Moreover, the Ancient Egyptian word for the cranial vertex is *wpt* which means to open, to discern, or to judge. The Ancient Egyptian word for cerebrum is *âmm* and means to know and to understand. This shows that the Egyptians knew that the brain was connected to knowing, understanding, judging, and discernment. Professor Obenga points out that Case 22 of the *Edwin Smith Papyrus* shows that brain damage can impair a patient's ability to speak.

In the Old Kingdom Period (i.e. Dynasty One to Six), the doctors were

specialists--they focussed on just the eyes, head, teeth, or intestines, etcetera. There was even a separate guild of bone setters who treated fractures and dislocations and pioneered the very same techniques that Hippocrates, the Ancient Greek scholar, would popularise thousands of years later. The Egyptian medical doctors were employed by the state. One Old Kingdom position was ‘Chief of Dentists and Physicians.’ Another position was ‘Director of the Women Doctors.’

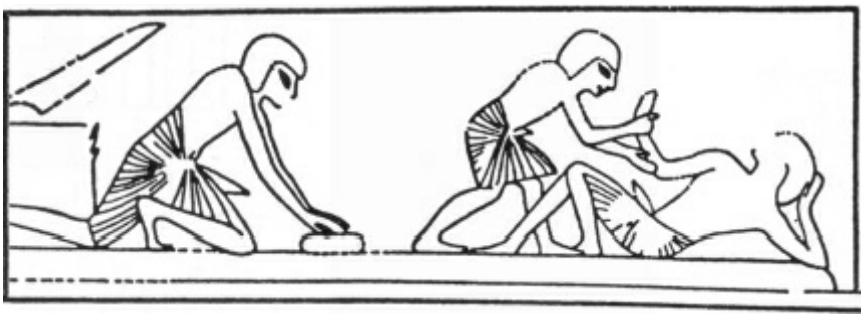

Figure 12. Detail of a wall carving showing a person setting a dislocated shoulder.

Incidentally, nearly 120 physicians appear in the Egyptian annals. Typically, they were trained in an institution called the ‘per ankh.’ At once, this served as a school, library, clinic, temple and seminary. Much of the teaching and training was taught orally as was done elsewhere in Africa.

Described in both the *Edwin Smith* and the *Ebers Papyri,* the Ancient Egyptian doctors pioneered the use of the diagnostic method. Thus, the patient describes the complaint to the doctor. The doctor then assessed the patient checking over the face, the eyes, nasal secretions, perspiration, and testing for stiffness of limbs or the abdomen. The doctor would ask for a urine and a faeces sample. They took the patients pulse. We know that the Egyptians invented the hour but they must also have invented smaller units of time. Did they invent the minute and the second also? Finally, the doctor percussed the abdomen or chest of the patient.

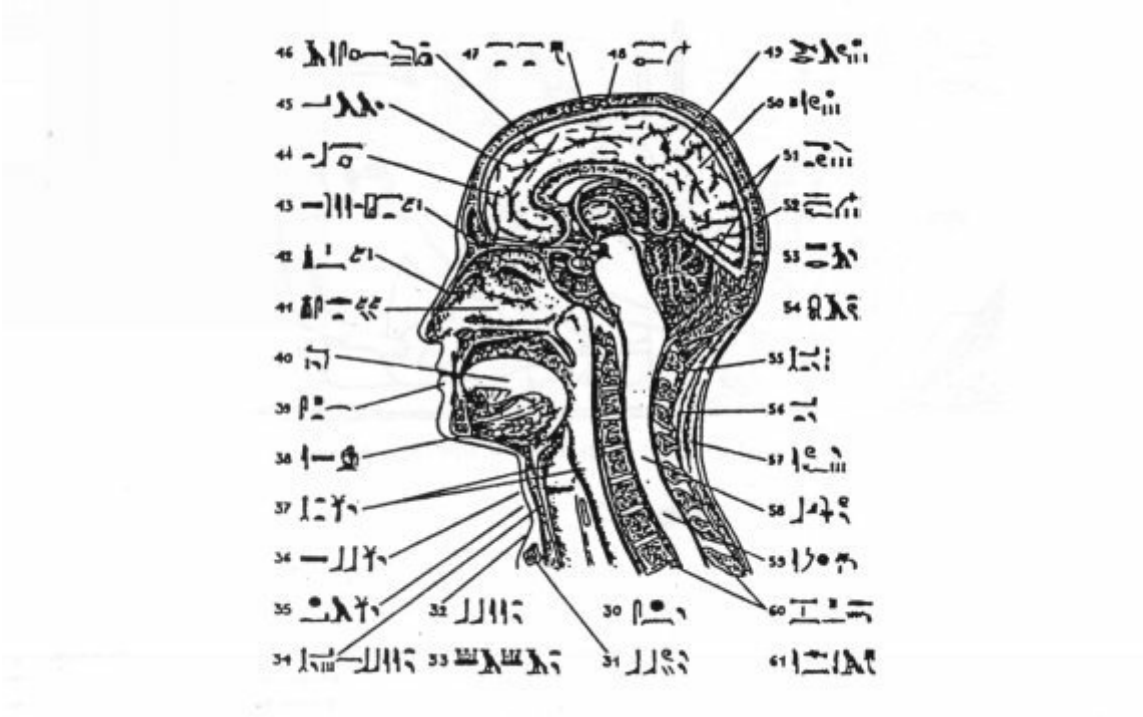

Figure 13. The Ancient Egyptians had anatomical terms for parts of the brain and other anatomical features of the head, many of which have been identified here.

The Ancient Egyptians used a *Materia Medica* of 1,000 animal, plant and mineral products. This is a large pharmacopeia since they could also combine these animal, plant and mineral products. They used moulds from bread, i.e. from the penicillium family, internally and externally to treat infections. Thus they created the first antibiotic. They used poppy extract, i.e. opium, to treat colicky babies and as a sedative and pain killer. They used ox livers, rich in vitamin A, to treat night blindness. They used onions, rich in vitamin C, to treat scurvy. They used Mandrake or related plants for sedation and to treat eye disorders. They used honey combined with grease as a wound salve. This has been shown to speed up the healing of wounds and reduce infections. Finally, they dispensed prescriptions as pills, enemas, suppositories and elixirs.

Imhotep, a Third Dynasty Prime Minister, was the first great individual in recorded history. Before him, history was strictly about Gods and Kings. Imhotep was an intellectual of wide interests including medicine. In western culture, it has become customary to give credit to the Greek scholar Hippocrates as the pioneering medical doctor. Medical practitioners today have the option of swearing on the Hippocratic Oath to promise that they will do no harm to their patients. However, the Oath is dedicated to the gods Apollo and Aesculapius. Aesculapius is none other than Imhotep!

Even more embarrassing, Professor Cheikh Anta Diop reports the following information: ‘Theophrastus, Dioscorides, and Galen perpetually cite the prescriptions that they received from the Egyptian physicians, or more specifically, as Galen says, that they had learned by consulting the works conserved in the library of the Temple of Imhotep at Memphis, which was still accessible in the second century A.D., and where, seven centuries before, Hippocrates, the “father of medicine” was taught.’

Figure 14. Statuette of Imhotep, the great Third Dynasty era Prime Minister, Architect and Medical Doctor. He has handsome African features typical of the Ancient Egyptians during this period of history.

The Ancient Egyptians also invented a contraceptive solution. It was a concoction whose active ingredient was a spermicide that did actually kill sperm.

They also pioneered a pregnancy test which involved sprinkling urine of a possibly pregnant woman on barley to test how the barley grew. Modern scholars say this test was 40% successful. This is a low figure, but we must remember that modern pregnancy tests are far from reliable!

Finally, the Kushites in the land to the south of Egypt also made use of antibiotics. They pioneered in the use of tetracycline.

Chapter 4: Navigation and Cartography

It may surprise readers to know that Africa has contributed a lot more to shipping, navigation and map making than many of us have been led to suspect. Maritime activity has a long history in Africa. In the time of Pharaoh Sneferu (4872-4824 BC) of the Fourth Egyptian Dynasty, the Palermo Stone Annals record that 40 ships returned from Canaan in the Middle East laden with cedar trunks. An Egyptian ship from the time of Khufu, his son, has survived and has been reassembled. Professor Finch says that it was '25 feet longer than Columbus' flagship, the *Santa Maria* .'

The Greek historian Diodorus Siculus reported that the largest ship in the fleet of 'Sesostris' was 480 feet long. However, when the Greeks speak of Sesostris, sometimes they mean the Twelfth Dynasty rulers Senwosret I, II, or III. Other times they mean Rameses II of the Nineteenth Dynasty. We therefore cannot be sure of whom Diodorus was speaking. Which ever be the case, one of the Twelfth or Nineteenth Dynasty ships was four times the length of Columbus' *Santa Maria* .

Pharaoh Hatshepsut (1650-1600 BC) of the Eighteenth Dynasty commanded a voyage to Punt. Scholars are unsure of where this country was but the general view is that it was either Ethiopia or Somalia. The wall frescoes in Hatshepsut's Temple in Deir-el-Bahri depict the main vessel with its sails. Even more impressive, however, were the obelisk barges used in Hatshepsut's time to more the vast obelisks from Aswan to Karnak. Professor John Pappademos, a modern authority on Ancient Egyptian science and technology, wrote: 'The obelisk barges of Queen Hatshepsut have been estimated at 95 metres in length, with a beam of 32 metres and a deadweight

of 2500 tons. Such a barge would dwarf Lord Nelson's flagship the H.M.S. Victory at the battle of Trafalgar.'

Since the Ancient Egyptians had sophisticated shipping, a question has been raised about whether or not they visited Ancient America. A generation ago, Norwegian explorer, Thor Heyerdahl, set about testing this theory. He wanted to know whether Africans had visited the Americas before 1492, the time of Columbus. He hired expertise from the Baduma People of Lake Chad led by Mr Abdullah Djibrine, and commissioned them to build a boat in traditional style from papyrus reeds. They built and launched the ship, sailing from Safi in North Africa across the Atlantic, but there was one key fixture missing from the ship.

Unfortunately, the ship, Ra I, disintegrated. The missing fixture held the key to why the voyage failed. However, the failed ship STILL GOT ALMOST AS FAR AS BARBADOS! Thus, it was indeed possible that early Africans had the technology to visit the Americas well before 1492. Thor Heyerdahl wrote a 1971 book on his experience *The Ra Expedition*, and a 1972 television documentary.

Figure 15. Constructed in traditional style, this is Ra I photographed on the high seas in 1969.

There were a number of great Native American Civilisations that existed in Ancient and Mediaeval times. Among these were the Olmecs, but also the civilisations of the Mayans, the Incas, the Mixtecs and the Aztecs.

The first or oldest was the Olmec Civilisation (*c.* 1200-400 BC). Olmec apparently means ‘People of the Jaguar.’ The other Native American civilisations developed from the Olmec base and thus the Olmec Civilisation is the most important and ultimately the most controversial.

In 1858 the first major relic of Olmec art was found by peasants at a Mexican village called Tres Zapotes. It was a colossal stone head, 8 feet high and weighed 10 tons. In 1862 José M. Melgar found a second stone head. Unlike the earlier peasants, Melgar was in a position to write up and draw scholarly attention to his findings. His report appeared in the *Mexican Society of Geography and Statistics* in 1869. A key statement in the report read as follows: ‘I reflected that there had undoubtedly been Negroes in this country, and that this had been in the first epoch of the world.’

In 1939 the Smithsonian Institute and National Geographic commissioned Mr and Mrs Matthew Stirling to remove the heads. Since then, a further fourteen Olmec stone heads have been found. Two from Tres Zapotes, four from La Venta, six from San Lorenzo and the remaining four from a number of other sites.

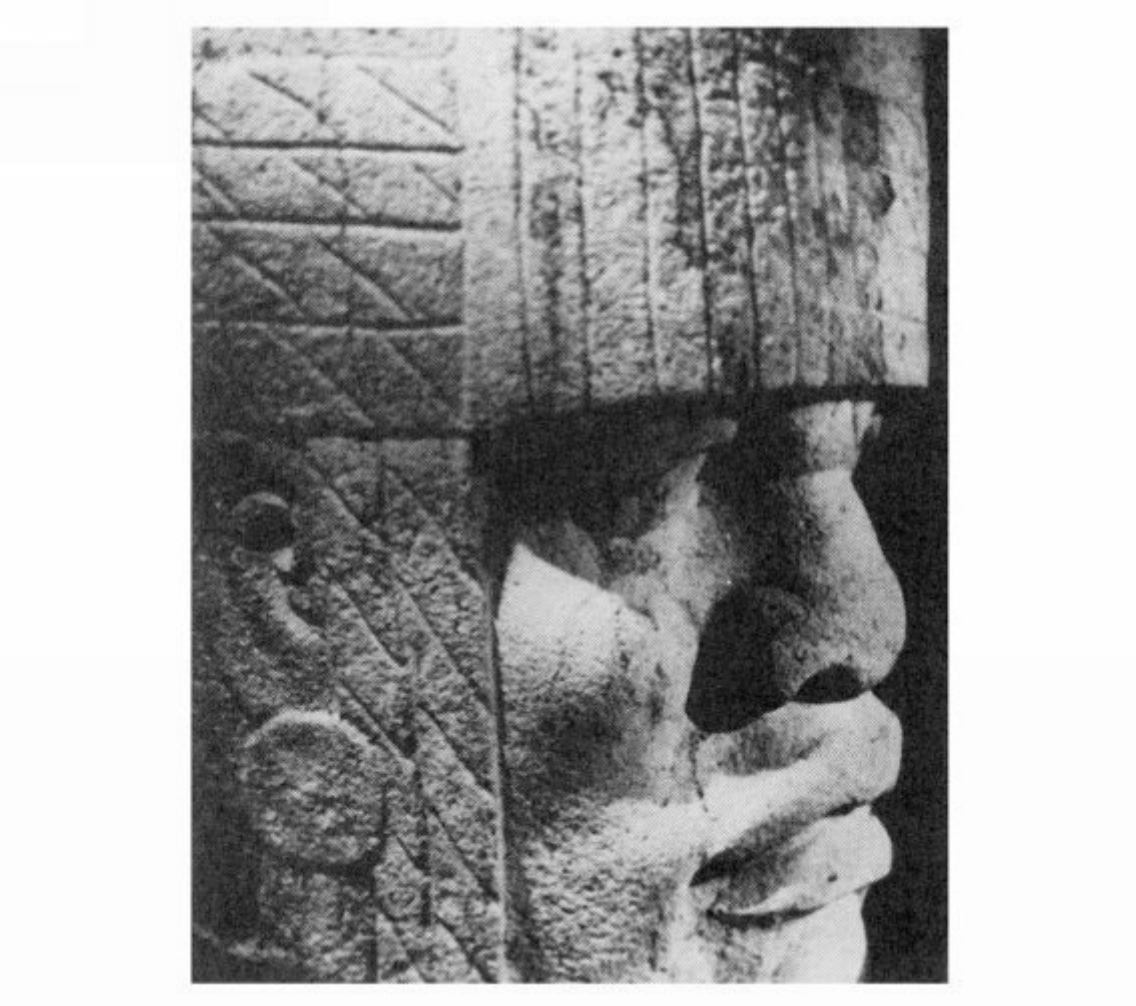

Figure 16. Superb colossal stone head found at San Lorenzo showing African facial features and well over two thousand years old.

How do we interpret this data?

A number of scholars have presented ideas that could well shed light on this issue. Professor Ivan Van Sertima wrote *They Came Before Columbus* in 1977 Dr Andrej Wiercinski presented a paper which appeared in the *Proceedings of the 41 st International Congress of the Americanists* in 1974. Count Alexander Von Wuthenau wrote *Art of the World: Pre-Columbian Terracottas* in 1969. Rafique Ali Jairazbhoy wrote *Ancient Egyptians and Chinese in America* in

1974. Finally, Professor Charles Hapgood wrote *Maps of the Ancient Sea Kings* in 1966. He does not address the Olmec issue directly, concentrating instead on the Piri Re'is Map of 1512/1513, but his findings do impact on our understanding of this tantalising issue.

Professor Ivan Van Sertima was a Guyanese anthropologist turned historian. In *They Came Before Columbus,* 1977, he identifies the helmets worn by the Olmec heads as the military helmets worn by Nubian soldiers during the late Egyptian periods. However, he denies that the Olmecs were Africans. He is clear that the Olmecs were Native Americans. He does, however, infer that Africans were highly esteemed among their Native American hosts. Hence the Olmecs making the massive stone heads depicting the Africans and erecting pyramids in the African style.

Van Sertima also highlights cultural similarities of a type that one might expect if one culture influences another. For example, the pharaohs of Africa's Nile Valley wore a red and white double crown. There is an image of an Olmec dignitary at Cerro de la Piedre wearing a double crown. Secondly, the pharaohs wore a false beard that supposedly represented age and wisdom. In Native American art there are false beards depicted on distinguished persons. Thirdly, the flail is a symbol of authority held by African kings and chief dignitaries. There is a painting at Oxtotitlan of a man holding a flail in an African manner. Fourthly, purple was a symbol of royalty and for priests in the Nile Valley yet there is a San Lorenzo head painted purple.

Professor Beatrice Lumpkin is a mathematician who became part of the Van Sertima Journal of African Civilisations team. She wrote a paper called

Pyramids – American and African: A Comparison where she points out that both the Mexican and African Pyramids have a north-south orientation and both functioned as astronomical observatories.

Dr Andrej Wiercinski, a Polish craniometrist, presented a paper published in the *Proceedings of the 41 st International Congress of the Americanists* in 197 based on research he completed in 1972. He examined skeletal remains from 2 elite Olmec burial sites and found that at Tlatilco, the earlier site, 13.5% of the individuals buried there were Africans. At the later site of Cerro de las Mesas, 4.5% of the individuals buried there were Africans. The burials had African males interred next to Native American females.

How should this be interpreted? This may well indicate that the African visitors to Mexico joined the elites. It may also suggest husband and wife burials. The data may well be evidence that the Africans were being absorbed by the Native Americans through intermarriage. This may explain how 13.5% became 4.5%.

There are, however, SEVERE weaknesses with Wiercinski's methodology and thus his findings need a careful interpretation. The weaknesses, however, are not what his many critics claim it is. His criteria for determining who belonged to what race was not overly lax when it came to identifying Africans but on the contrary, he was overly strict. Thus many African skulls that are genuinely Negro, Wiercinski would have classified as Mulatto. Only those Africans with the most pronounced Negro features would meet Wiercinski's Negro category! Therefore the truer figure for the numbers of Africans in the Olmec burials could have been higher than the figures Wiecinski reported.

Count Alexander Von Wuthenau was a German art historian with a specialism in the art of Ancient Mexico. He was a speaker at an event hosted by President Senghor in Dakar in 1966. He is also the author of *Art of the World: Pre-Columbian Terracottas,* 1969 and *Unexpected faces in Ancient Mexico,* 1976. Count Von Wuthenau also contributed to some of Van Sertima's books. His photographs of Olmec period art are replete with sculptures that clearly depict Africans.

Jacqueline Patten-Van Sertima was the Photographic and Artistic Director of the Journal of African Civilizations. She also has photographs of Olmec era art where Africans are clearly depicted.

Rafique Ali Jairazbhoy was an Indian scholar who used to live in Britain. He is an advocate of an idea, once popular among anthropologists called 'diffusionism.' This is the idea that many different cultures had elements that could be traced back to a parent civilisation. This eminently sensible idea fell out of favour when scholars realised that Africa was the cradle of humanity and civilisation. All of a sudden diffusionism became a dirty word not to be used in polite anthropological company. This is still the case today. Whichever be the case, Jairazbhoy wrote *Ancient Egyptians and Chinese in America* in 1974.

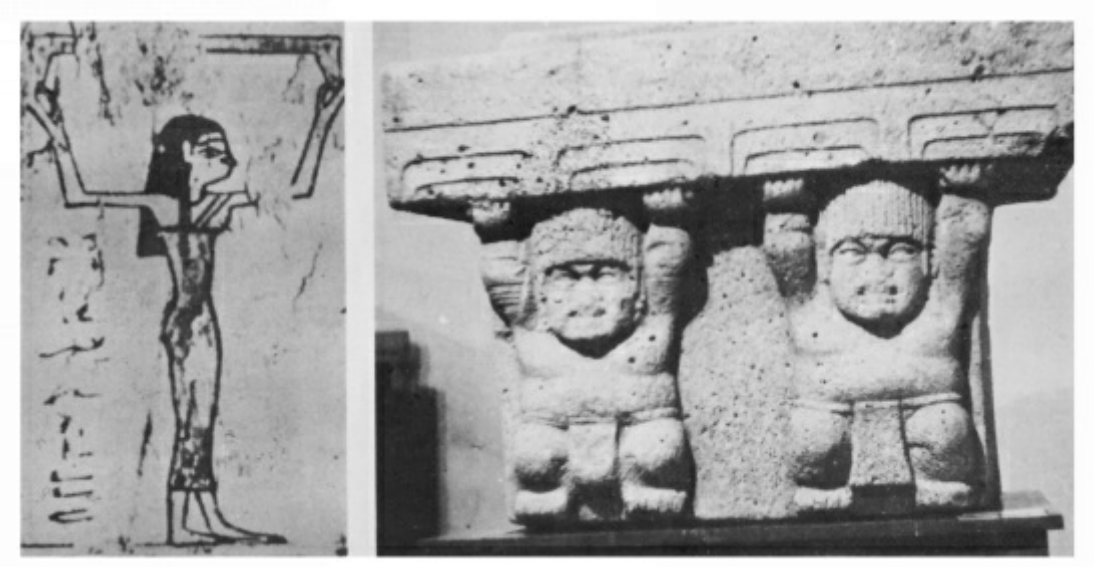

Figure 17. In these photographs, Jairazbhoy points out the similarity between the Ancient Egyptian Goddess Nut holding up the sky with the hieroglyphic sign for 'sky' above her head with these ancient Mexicans also holding up the sky. Notice the similar symbols above their heads that closely resemble the Egyptian sign for sky.

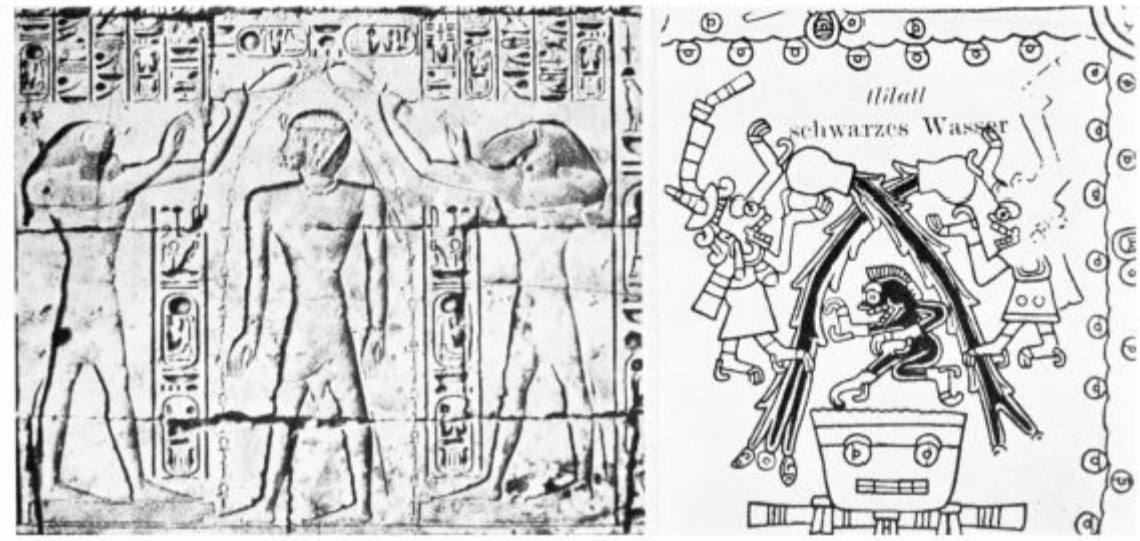

Figure 18. In these examples, Jairazbhoy points out the similarity between the two Egyptian deities pouring libation over the head of the pharaoh where the two streams of water cross each other with a scene from an early Mexican codex where two deities pour libations over the head of an individual again with the two streams of water crossing each other.

Mr Jairazbhoy names the pharaoh who sent the voyages to Ancient America as Rameses III of the Twentieth Dynasty (1230-1199 BC). Citing Egyptian documents that mention that Rameses III sent ships to the ends of the earth and to the mountain in the far west of the world, he identifies these places as Central America. Jairazbhoy shows a huge number of parallels between Olmec Mexico and Nile Valley Africa. In a later book, Jairazbhoy strengthens his claims. He now believes that the Ancient Africans created the Olmec civilisation. The 1992 book is entitled *Rameses III: Father of Ancient America*.

Professor Charles Hapgood, a cartographer then at the University of New Hampshire, wrote *Maps of the Ancient Sea Kings* in 1966. Much of the book deals with the research that him and his doctorate students completed on the

Piri Re’is Map of 1512/1513. Piri Re’is was a Turkish admiral of the sixteenth century. He wrote the *Book of Piri Re’is* with the sole aim of discrediting Columbus. Unimpressed by the claim that Columbus had discovered the Americas, Piri Re’is accused Columbus of possessing maps that date back to the time of Alexander the Great that had the Americas already mapped on them. To bolster this claim, Piri Re’is produced his own map which clearly has Brazil and Mexico depicted on it and with a high degree of accuracy. In compiling his own map, Piri Re’is used 30 source maps including at least one from the Egyptian city of Alexandria.

Figure 19. The Piri Re’is Map of 1512 or 1513. It clearly has Brazil and Mexico accurately depicted on it.

Professor Hapgood and his students, believing that the Alexandrian map or maps were the key to the Piri Re’is map, tried to find the geodetic centre of the original Alexandrian map or maps on which Piri Re’is was based. They found that the geodetic centre was 100 miles west of Syene i.e. Aswan. Thus the original cartographer or cartographers responsible for the key map or maps on which the Piri Re’is Map was based were standing on the ancient

border between Nubia and Egypt, 100 miles west of Aswan!

So what conclusions should we draw?

Professor Finch cited earlier sees this as proof that Nile Valley Africans from Egypt and Nubia visited the Americas in ancient times and mapped it.

Professor Hapgood and his students point out that the Piri Re'is Map also accurately details Antarctica before it iced over. They therefore conclude that the key source maps used by Piri Re'is were not just ancient, but were actually pre-historic. While they are sure in locating the geodetic centre of the map 100 miles of Aswan they draw no simple conclusions from this fact. Instead, they conclude: *' We shall now assume that some 20,000 or more years ago, while paleolithic peoples held out in Europe, more advanced cultures existed elsewhere on earth, and that we have inherited part of what they once possessed.'* (p.194)

We conclude that there were actual contacts between the Nile Valley and Ancient Mexico evidenced by the numerous examples of art and portraiture made by the Native Americans that clearly depict Africans. Agreeing with Van Sertima, we believe that the Olmec Civilisation was an indigenous Native American culture. We further believe that Africans visited them and introduced some new ideas and concepts that influenced Native American art and ritual. Heyerdahl has shown that Africans had the capability to make the voyages and the numerous parallels demonstrated by Van Sertima and Jairazbhoy makes this conclusion inescapable. We believe that the evidence presented by Wiercinsky suggests that Africans intermarried into the Olmec elites and were gradually absorbed. Agreeing with Jairazbhoy, we believe

that the voyages from Africa to the Americas took place during the time of Rameses III, if not earlier. Finally, we believe that Professor Finch is correct to infer that early African visitors to the Americas mapped at least some of the Americas and portions of this information has survived in the Piri Re’is map.

Chapter 5: Architecture

Architecture is a combination of art and technology and often encompasses the uses of many other sciences in their constructions. A typical building is analysed by its plan, its walling which includes the building materials, the openings (i.e. the doorways and windows), the supports, the roofing, and the ornamentation.

Pharaoh Djoser, the second king of the Third Egyptian Dynasty, ruled between 5018 and 4989 BC. He built the earliest monument in the world still celebrated today. Every year, thousands of tourists visit his Funerary Complex in the city of Saqqara. Imhotep, his celebrated Prime Minister, designed the Complex.

An outer wall, now mostly in ruins, surrounded the whole structure. It was built on a rectangular plan, one mile long, and with one entrance. Through the entrance are a series of columns, the first stone-built columns known to historians. Connected to walls, they are ornamental having been modelled on plant stems grouped together. The North House also has ornamental columns built into the walls that have papyrus-like capitals. Also inside the complex is the Ceremonial Court. Like everything else these buildings are solid and are thus symbolic. The Court is made of limestone blocks that have been quarried and then shaped. In the centre of the complex is the Step Pyramid, the first of 90 Egyptian pyramids. Made of limestone blocks, it is 197 feet high. Unlike the later pyramids, this structure is built on a rectangular plan measuring 345 by 414 feet – equivalent to a base of 14,000 square yards. It has 6 steps and may represent a stairway. The building slopes at an angle of 72º 30’. Under the Pyramid were a series of rock-hewn chambers and corridors. They are

ornamented with panels of colourful tiles. In these hidden quarters, Djoser and eleven others are said to have been buried. On the importance of the Djoser Complex, Professor Finch noted that: ‘[It] was humanity’s first great architectural triumph. It established architectural forms, styles, and canons still in use today. The practical building technique and masonry evident in the entrance temple were never surpassed, though … they were realized on a grander scale.’

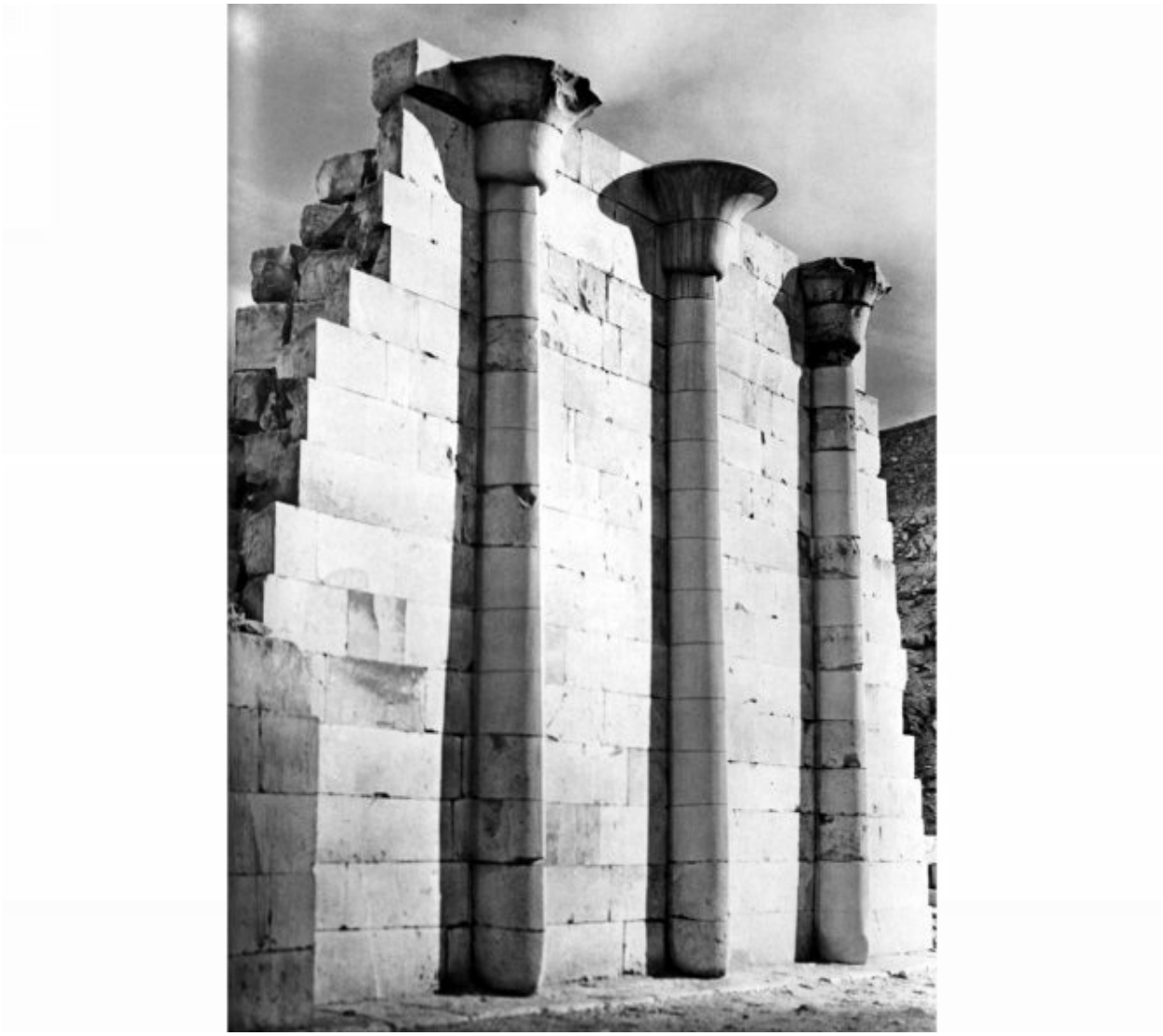

Figure 20. Detail from the North House of the Saqqara Complex. This monument contains the first attempt to build columns in human history.

The monuments ‘on a grander scale’ include the structures built by the Fourth Dynasty Pharaohs – the Step Pyramid of Meidum, the Bent and Red Pyramids of Dashur, and the three Great Pyramids of Giza – monuments built between 4872 and 4615 BC. Of these, the most impressive is the first Great Pyramid of Giza. It was 481 feet tall, the equivalent of a 40 storey building. It was made of 2.3 million blocks of limestone and granite, some weighing 100

tons. The accuracy of the construction work remains astonishing. Dr Alfred Russell Wallace, a famous British scientist, commented on this more than a hundred years ago in an address before the British Association for the Advancement of Science: ‘1. That the pyramid is truly square, the sides being equal, and the angles right angles; 2. That the four sockets on which the first four stones of the corners rested are truly on the same level; 3. That the directions of the sides are accurate to the four cardinal points [of north, south, east and west]; 4. That the vertical height of the pyramid bears the same proportion to its circumference at the base as the radius of a circle does to its circumference [i.e. the Egyptians understood π].’

Pharaoh Senwosret II (3331-3299 BC) of the Middle Kingdom constructed Kahun, a town of officials, priests and workers. It had over a hundred houses where even the smallest homes for people of the lowest rank had 4 to 6 rooms and an area of 1,022 square feet or larger.

Excavations revealed that this city was the world’s first known example of town planning. Kahun was rectangular and walled. Inside, the city was divided into two parts. One part housed the wealthier inhabitants – the scribes, officials and foremen. The other part housed the ordinary people. The streets of the western section in particular, were straight, laid out on a grid, and crossed each other at right angles. A stone gutter, over half a metre wide, ran down the centre of every street. Positioned to benefit from the cool north winds, five single storey mansions were found along the northern edge of the city. Their doorways were arched. Each boasted 70 rooms, divided into four sections or quarters. There was a master’s quarter, quarters for women and servants, quarters for offices and finally, quarters for granaries, each facing a central courtyard. The master’s quarters had an open court with a stone water

tank for bathing. Surrounding this was a colonnade. Of the maze of rooms, some were barrel vaulted in brick but others were wooden and thatched. The ceilings were supported by wooden and stone columns some with palmiform capitals. Limewash coated the walls, but some rooms contained frescoes.

Figure 21. Plan of a part of Kahun, showing houses of similar layouts and streets laid out on a horizontal vertical grid.

Amenemhet III (3242-3195 BC) of the same dynasty built at Hawara the Labyrinth with its massive layout, multiple courtyards, chambers and halls. The very largest building in antiquity, it boasted 3,000 rooms. One thousand five hundred were above ground and the other one thousand five hundred were underground. Herodotus, the Ancient Greek historian, saw it in ruins three thousand years later. He was still somewhat impressed: ‘I visited this place, and found it to surpass description; for if all the walls and other great works of the Greeks could be put together in one, they would not equal, either for labour or expense, this Labyrinth; and yet the [Greek] temple of Ephesus is a building worthy of note, and so is the temple of Samos. The pyramids likewise surpass description, and are equal to a number of the greatest works of the Greeks; but the Labyrinth surpasses the pyramids.’

Further south lay the complex of temples in the city of Waset. The Karnak and Luxor temples, now in partial ruin, were built over many years with contributions from different pharaohs of the Twelfth, Eighteenth, Nineteenth and Twenty-Fifth Dynasties (3405-664 BC). The Karnak Complex was a place of culture and business. It should be thought of as an abbey since people lived and worked there and the complex was self-contained. The treasures of the ancient world passed through its corridors; gold and precious woods from Kush, tribute from Syria, and vases from Crete. A procession of sphinxes led to the outer pylon, itself 370 feet across, 143 feet high, and 49 feet thick at the base, but becoming narrower at the top. Behind the pylon was the Temple of Amen, which originally had huge doors to close it off. A place of unbelievable luxury, the Hypostyle Hall, just one of its many temples, was 171 feet long and 338 feet wide, covering an area of 56,000 square feet. It was the largest enclosed space in Egyptian architecture, even larger than Durham Cathedral by 5,000 square feet. It contained 134 sandstone columns, covered with bas-reliefs and hieroglyphics. An architect described the Hall as follows: 'No language [says Fergusson] can convey an idea of its beauty, and no artist has yet been able to reproduce its form so as to convey to those who have not seen it any ideas of its grandeur. The mass of its central piers, illuminated by a flood of light from the clerestory, and the smaller pillars of the wings gradually fading into obscurity, are so arranged and lighted as to convey an idea of infinite space; at the same time the beauty and massiveness of the forms, and the brilliancy of their coloured decorations, all combine to stamp this as *the greatest of man's architectural works.'*

Figure 22. Masterly decorated capitals from columns in the Karnak Complex.

There were huge obelisks that stood before the façades of the Karnak and Luxor temples. They were made of a single piece of stone that was hewn from a quarry and then transported to the required position. Pharaoh Hatshepsut erected one such obelisk. It was 90.2 feet tall and weighed an astonishing 302 tons. There is a huge and unfinished obelisk that is 41.78 metres long that was left at Aswan, presumably because it did not meet exacting standards of accuracy. The importance of these monuments are such that one authority has argued that there is a typological and symbolic link between the obelisks of ancient times and the skyscrapers of today. As Dr Nnamdi Elleh, an expert in African architecture, put it: ‘Several texts exist of Pharaohs boasting that they erected obelisks which reached, pierced, or mingled with the sky.’

Pharaoh Hatshepsut (1650-1600 BC) of the Eighteenth Dynasty was also the builder of one of Egypt’s most popular monuments. Senenmut, the Overseer

of Works, constructed her temple in the region now known as Deir-el-Bahri.

Rather than build upwards from a base, the Mortuary Temple was built downwards, being cut out of a mountain. The whole building was hewn from the rocks by hammer and chisel. The result is a pillared terrace structure that rises in three stages with 2 central ramps, also carved and sculpted. The ramps are long and slope with a gentle gradient. Their position divides the temple into two symmetrical halves. Entrance halls of limestone columns lead to the interior chapels dedicated to the deities Anubis, Hathor, Osiris and Ra. Through the colonnade, the interior has wall reliefs that depict Hatshepsut's maritime voyages to Punt (i.e. possibly Somalia or Ethiopia) showing also the round houses of that country. In its time, great sculptures embellished the building. There were over 100 limestone sphinxes, 22 granite sphinxes, 40 limestone statues of Hatshepsut, and 28 granite statues of Hatshepsut.

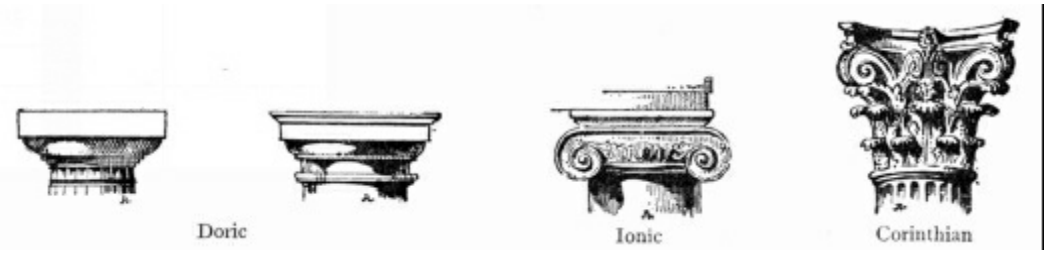

Figure 23. It is not difficult to trace the development of architecture from the Saqqara Complex, through the Karnak Complex to the evolution of Greek architecture. Greek capitals are typically classified as Doric, Ionic or Corinthian.

Rameses II of the Nineteenth Dynasty also built a temple carved out of a hill. The Temple of Abu Simbel, in Nubia, is of an incredible scale.

The façade is 108 feet wide and contains four colossal statues of the pharaoh, each 66 feet high. What is remarkable here is the organisational feat involved. The carved images of Rameses are so large that each builder/sculptor would be so close to their work that none of them would be able to see the bigger picture as they worked. For this reason, accuracy was critical and not just for artistic reasons. The building was oriented to the east to catch the first rays of sunlight that illuminated its icons at the end of a 208 feet corridor. Inside the entrance to the temple are statues of the deity Osiris. This led to a smaller hall that led to an inner chamber.

Chapter 6: Others

Hunter Adams III, an African American science writer, mentions other areas of intellectual activity where the Ancient Egyptians made important contributions – Harmonics, Electroplating and Aeronautics.

According to him: ‘The Egyptians were the first to formalize the mathematical properties of music … This mathematical relationship, which results from the phenomenon of classical gravitation, constitutes the essential basis of musical harmony, one of the direct applications of which is the length of a harp string. The longest string emits a sound of a certain pitch. Another string, half this one’s length, emits a sound consisting of vibrations twice as rapid, and one octave higher. Thus all the intervals which define the seven notes of the diatonic scale represent the relationship between the string-lengths for any two notes which is the inverse of the relationship between their rates of vibration.’

The Ancient Egyptians invented the diatonic scale. This scale is the basis of contemporary western music and its origins can be traced back to flutes that have been discovered in Ancient Egyptian tombs. Thirty of these instruments have been found that play the diatonic scale and Professor Obenga is of the opinion that these flutes have been in use since at least the Fifth Dynasty period.

Adams mentions sophisticated Egyptian metallurgical objects that could only have been produced using very modern techniques: ‘Electroplated gold and silver objects have been found in Egypt from roughly the Middle Kingdom … to the Greek era of the Ptolemies ... Nineteenth-century French

archaeologist Auguste Mariette in the *Grand Dictionaire Universal du 10th Siecle* describes such artefacts he found excavating an area near the Sphinx. Wooden flagstaffs about 30 metres tall, placed in front of Egyptian temples from the Middle Kingdom onward, had the top end capped with a sheath of gold-plated copper.'

Mr Adams was clearly baffled by this discovery. He asks: 'where did the source of electrical energy to plate one metal onto another come from?

As elsewhere dealing with Ancient Egyptian science and technology, the modern scholar stands somewhat baffled and in awe.

Another baffling fact is that perhaps fifteen objects have been discovered in Ancient Egyptian tombs that could be classified as model gliders. Hunter Adams reports on the most famous and controversial example of such a discovery: 'One of the more extraordinary artifacts of ancient Egypt was the discovery in 1898, in a tomb near Saqqara, of a model glider or sailplane made of sycamore wood dating from about [the] third or fourth century B.C. It lay undisturbed, buried in a box of "bird objects" in room 22 of the Cairo Museum's basement until 1969, when museum archaeologist, Dr Khalil Messiha and his flight engineer brother, Guirguis, rediscovered it. A special research committee was established by the Egyptian Under Secretary of the Ministry of Culture, M. G. Mokhtar, in December of 1971 to investigate it. From their examination of it and bird models in the museum the committee concluded that this object definitely was not a bird – but a model glider.'

For some reason, this particular discovery has been cited frequently to discredit African American scholars who have made investigations into the

history and culture of Ancient Egypt. There has been a media campaign initiated by various European American scholars to suggest that anyone who says this particular object is a glider and not a bird is a Black scholar making up history. The truth of the situation however, is that no Black scholar was involved in the discovery of the artefact, nor was any Black scholar involved in classifying it as a glider. All of this research work was carried out by contemporary Arab Egyptians.

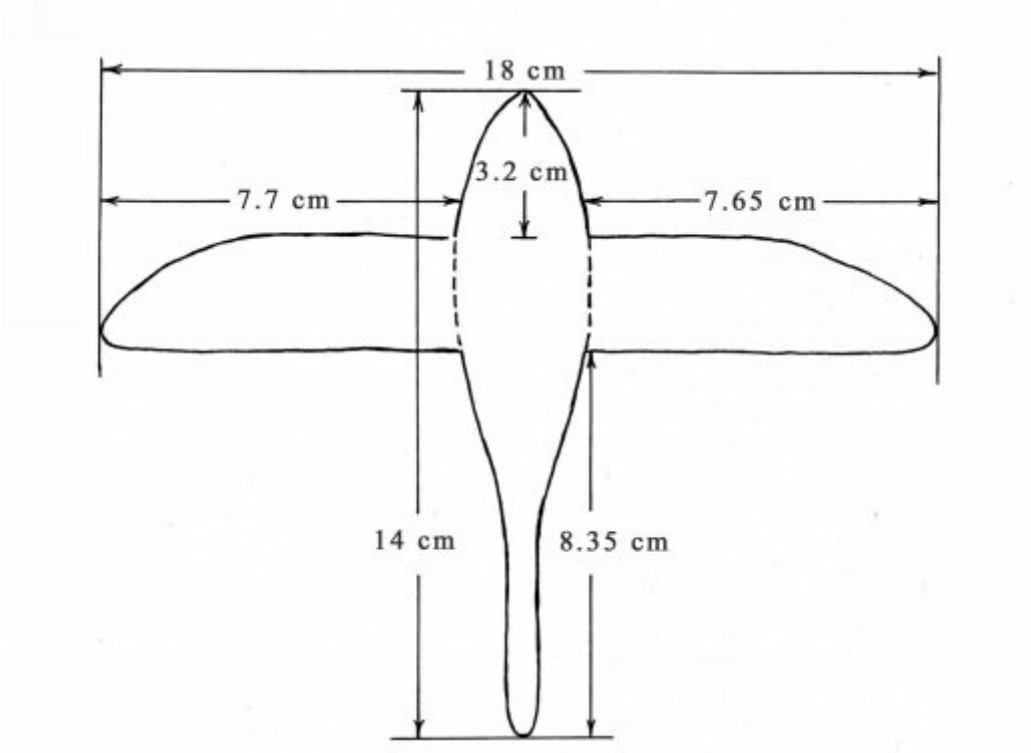

Figure 24. Controversial artefact discovered in 1898 and analysed in 1971. Dr Gamal Mokhtar issued an *Official Statement on the Messiha Discovery* where he stated: 'Few days ago, members of the International Aerospace Education Committee, who met in Cairo for the first time, were surprised when they visited the Egyptian Museum. This was not the normal surprise of visitors coming to the Museum for the first time, but also a surprise to see the model of an aeroplane 2300 years old.'

Professor Finch informs us that the Egyptians were working copper in prehistoric times suggesting dates such as 7500 to 6500 BC. Archaeologists have found copper beads, pins, bracelets, chisels, rings, harpoon heads, needles and tweezers. By the Fourth Dynasty period, bronze artefacts (i.e. copper combined with 4 to 15% tin) have been recovered. The Egyptians were working gold in pre-dynastic times. Archaeologists found gold beads, a golden ring, a gold cylinder seal, vases covered in golden foil, and knives covered in golden foil. Some objects were of gold alloyed to copper or silver.

The Egyptians worked iron as early as pre-dynastic times. However, the oldest known significant piece of iron is a portion of a tool found lodged between joints of the masonry of the Great Pyramid of Giza. Finally, the Egyptians were working steel (i.e. iron combined with carbon) by 1200 BC. Two knife blades were found made of low carbon steel of 0.7%.

Mr Adams brilliantly summed up the important role of Ancient Egypt in the history of science and technology and we give him the final word: ‘To them, we owe the concepts of most of the fundamental physical quantities: area, volume, weight, distance, density, and time, along with standard units and accurate methods of measurements using these quantities. Regarding technology for example, today’s small metal locks and keys owe their basic design to large wooden locks and keys invented 4,000 years ago in Egypt as well as folding beds and chairs. In regard to medicine, they produced the first physicians, the first extensive medical literature and knowledge; the Western medical tradition is an extension of the Egyptian one, and not the Greek. In fact, the Greeks called Egypt the seat of scientific knowledge and sent many of its most brilliant scholars there to study such as Thales, Democritus, and Pythagoras.’

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For Further Reading

The most detailed single book where you can learn more about these topics and a lot more besides is Robin Walker's, **When We Ruled** (UK, Reklaw Education, 2013). However, at 818 pages some people may find it a very daunting prospect indeed!

I have written a series of bitesize lecture essays on various topics to do with Black history and economics. They are available from Amazon as ebooks. They are all part of the Reklaw Education Lecture Series.

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imagine life without the technological contributions of the African American inventors.
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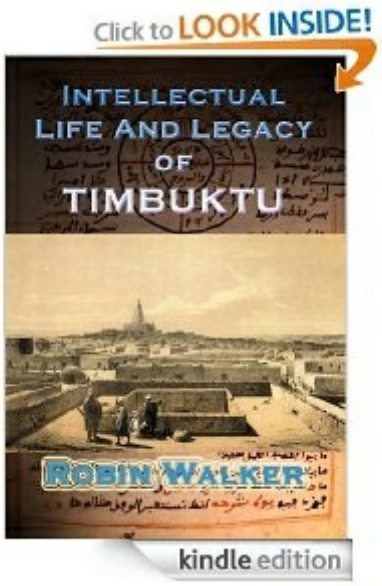

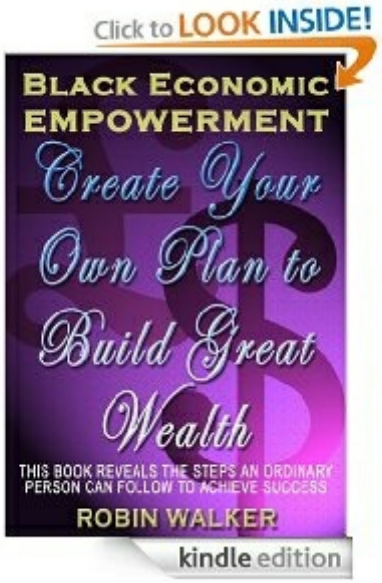
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